

REMARKS

In response to the **non-final** Office Action dated September 17, 2009, claims 17-19 have been canceled, and new dependent claims 35 and 36 have been added. No new matter was added. Thus, elected claims 20-36 are pending for further prosecution. Non-elected method claims 1 and 2 also remain in the application, as withdrawn. Rejoinder of non-elected method claims 1 and 2 is respectfully requested should the elected base claim be allowed.

Arguments for the patentability of the elected claims over the prior art of record are presented. In addition, a Sworn Declaration of Kouichi Takemoto, a named inventor, is submitted with respect to making factual statements on the record. Kouichi Takemoto has twelve years of experience in the research and development of electronic materials and is skilled in the art in producing copper sulfate and in copper electroplating processes used to manufacture microstructure semiconductor devices.

Accordingly, Applicants respectfully request reconsideration of the former rejections based on the prior art of record and respectfully submit that the present application is in condition for allowance.

I. Claim Rejections - 35 USC §102(b)/ §103(a)

- A. *In the **non-final** Office Action dated September 17, 2009, claims 20-34 are rejected under 35 USC §102(b) as being anticipated by JP 05-262523 A or, in the alternative, are rejected under 35 USC §103(a) as being obvious in view of JP 05-262523 A.*

As is well settled in U.S. patent law, the use of a word such as “high” in the phrase “high purity” is a relative term. As such, it is indefinite and of no significance unless a specific definition is given to such a relative term. In the case of “purity”, a numerical number is required to enable an appropriate teaching or comparison. For example, a purity of 80% may be

considered “high” when compared to a purity of 60%. Thus, Applicants respectfully submit that the relative use of the term “high” in JP ‘523 fails to provide an enabling disclosure of copper sulfate having 4N (99.99wt%) purity as required by the claims of the present invention.

Further, a purity of 4N (99.99wt%) or higher indicates that there is 0.01wt% or lower of impurities. This converts to 100wtppm or less of impurity content. A purity of 5N (99.999wt%) converts to a purity of 10wtppm or less of impurity content. These are extremely low levels and are required by the present invention due to the intended use of the copper sulfate as an electroplating solution in the manufacture of microstructure semiconductor devices. Any impurities in the copper sulfate will become impurities that are concentrated in the plated coating of the microstructure semiconductor device. Such impurities in the microstructure wirings, thin films, etc. will have an adverse effect on the performance of the semiconductor device.

By way of example, page 1, lines 26-27, of the present application acknowledges that, at the time of the present invention (2002), commercially available copper sulfate was of a purity of 95wt% (1N5) to 99.9wt% (3N). The impurity content of a 3N purity copper sulfate is 1000wtppm. As best explained on page 11, lines 5-13, of the present application, as filed, even 3N purity copper sulfate in an electroplating solution produces an unacceptable amount of foreign matter and impurities and provides inferior embedding characteristics that adversely affect the performance of a microstructure semiconductor device.

Turning to JP ‘523, it is directed to a method of producing, at low cost and in a short time, a copper sulfate solution directly from metallic copper powder without going through copper oxide powder. Accordingly, the emphasis is on **low cost and short manufacturing time**, not purity. In fact, no purity level is even referenced, defined, or enabled by JP ‘523. Thus, any use of the word “high” is completely irrelevant and impossible to accurately gauge.

This is best demonstrated where JP '523 requires the introduction of large amounts of fine air bubbles in the suspension of metallic copper powder, uses "industrial water" instead of purified water, and intentionally adds 18g/L of arsenic into the solution. Obviously, the "air blowing" will cause large amounts of air dust (impurities) to become mixed into the suspension, the use of industrial water will add large amounts of impurities into the solution, and the intentional addition of arsenic will clearly result in increasing the impurity content of arsenic in the solution.

Thus, to say that JP '523 teaches, enables, or renders obvious a copper sulfate having 4N or 5N purity (i.e., total impurity content of 100wtppm or less, or 10wtppm or less) is simply unfair and inaccurate. See the statements in the Sworn Declaration of Takemoto.

From the foregoing facts, Applicants respectfully submit that not only does JP '523 fail to disclose copper sulfate having a purity of 99.99% or higher, it is apparent that it is simply not possible to produce copper sulfate having a purity of 99.99% or higher from the teachings of JP '523. Thus, removal of the novelty/anticipation rejection under §102(b) is respectfully requested. Clearly, the product claimed by the present application is different than that disclosed by JP '523.

With respect to the rejection based on §102(b), it is well settled law that a claim of a patent application can be properly anticipated under 35 USC §102 only if each and every element is found described in a single prior art reference. The identical invention must be shown in as complete detail as contained in the claim, and the elements identified by the reference must be arranged as required by the claim. If a prior art reference relied on in a rejection made under 35 USC §102 does not contain every element recited in the claim in as complete detail as is contained in the claim and arranged as recited in the claim, the anticipation rejection is improper and should be removed. A purity of 4N is not disclosed or enabled by JP '523.

With respect to the rejection based on §103(a), Applicants respectfully submit that since it would not be possible for one of ordinary skill in the art to produce copper sulfate having a purity of 99.99% or higher from the teachings of JP '523, the claims of the present application are patentable and non-obvious relative to the disclosure of JP '523. Further, the criticality of the limitations recited by the claims of the present application is neither taught nor rendered obvious to one of ordinary skill in the art by JP '523. Still further, the copper sulfate disclosed by JP '523 does not provide the "same utility" as the copper sulfate required of the claims of the present invention which can be used to produce microstructure semiconductor devices via electroplating techniques.

For these reasons, Applicants respectfully request reconsideration and removal of the 35 USC §102(b) and §103(a) rejections of claims 20-34 as being anticipated by, or obvious over, JP '523.

*B. In the **non-final** Office Action dated September 17, 2009, claims 20-34 are rejected under 35 USC §102(b) as being anticipated by JP 47-040634 A or, in the alternative, are rejected under 35 USC §103(a) as being obvious in view of JP 47-040634 A.*

As discussed above, a purity of 4N (99.99wt%) or higher indicates that there is 0.01wt% or lower of impurities. This converts to 100wtppm or less of impurity content. A purity of 5N (99.999wt%) converts to a purity of 10wtppm or less of impurity content. These are extremely low levels and are required by the present invention due to the intended use of the copper sulfate as an electroplating solution in the manufacture of microstructure semiconductor devices. Any impurities in the copper sulfate will become impurities that are concentrated in the plated coating

of the microstructure semiconductor device. Such impurities in the microstructure wirings, thin films, etc. will have an adverse effect on the performance of the semiconductor device.

By way of example, page 1, lines 26-27, of the present application acknowledges that, at the time of the present invention (2002), commercially available copper sulfate was of a purity of 95wt% (1N5) to 99.9wt% (3N). The impurity content of a 3N purity copper sulfate is 1000wtppm. As best explained on page 11, lines 5-13, of the present application, as filed, even 3N purity copper sulfate in an electroplating solution produces an unacceptable amount of foreign matter and impurities and provides inferior embedding characteristics that adversely affect the performance of a microstructure semiconductor device.

Turning to JP '634, it acknowledges that Fe, Zn and Pb are contained in the copper concentrate as raw material and discloses a copper sulfate of maximum purity of 99.3%. Thus, the impurity content is 0.7% which converts to 7,000wtppm of impurities. Thus, the enabled impurity content of 7,000wtppm of JP '634 is far greater than that of 100wtppm, 10wtppm or less required by the claims of the present application. It should be acknowledged that, as impurity content is reduced, it becomes progressively more difficult to continue to further reduce impurities.

As discussed on page 11, lines 5-13, of the present application, as filed, a purity of 3N (99.9wt%) is unacceptable when producing microstructure semiconductor devices. Of course, 99.3% disclosed by JP '634 is worse.

Further, the intended usage of copper sulfate prepared by JP '634 as disclosed by JP '634 is as follows: "agricultural chemical (Bordeaux mixture), antiseptic agent (railroad crosstie, utility pole) starch for spinning, fishing net), Bemberg rayon, iodine production, ceramic material, pigment". The presence of an additional 6,900wtppm or more of impurities will have no impact in agricultural chemicals, antiseptic agents (for railroad crossties, utility poles, starch

for spinning, fishing nets), Bemberg rayon, iodine production, ceramic material, and pigment. Accordingly, JP '634 clearly has a different recognition on purity in comparison to the present invention. While the copper sulfate of JP '634 may be of "high" purity as viewed by JP '634 relative to the above referenced uses of the copper sulfate, the word "high" is clearly a relative term and one of skill in the art in the manufacture of microstructure semiconductor devices would not term the copper sulfate of JP '634 as being of a "high" purity. See the Sworn Declaration of Takemoto.

Applicants respectfully submit that the disclosure of 99.3% purity of JP '634 fails to disclose the level of purity required by the claims of the present application and thus fails to disclose the invention in as complete detail as contained in the claims as required for a rejection under §102(b).

With respect to the rejection based on §103(a), Applicants respectfully submit that since it would not be possible for one of ordinary skill in the art to produce copper sulfate having a purity of 99.99% or higher from the teachings of JP '634, the claims of the present application are patentable and non-obvious relative to the disclosure of JP '634. Further, the criticality of the limitations recited by the claims of the present application is not taught to one of ordinary skill in the art by JP '634. Still further, the copper sulfate of JP '634 fails to provide the "same utility" as that of the copper sulfate claimed by the present application. Thus, Applicants respectfully submit that the claims of the present application are not obvious in view of JP '634 and that the §103(a) rejection of the claims should be removed.

For these reasons, Applicants respectfully request reconsideration and removal of the 35 USC §102(b) and §103(a) rejections of claims 20-34 as being anticipated by or obvious over JP '634.

- C. *In the **non-final** Office Action dated September 17, 2009, claims 20-34 are rejected under 35 USC §102(b) as being anticipated by U.S. Patent No. 5,059,403 issued to Chen or, in the alternative, are rejected under 35 USC §103(a) as being obvious in view of U.S. Patent No. 5,059,403 issued to Chen.*

Chen discloses a copper sulfate having a “purity >99.8%”. This disclosed level of purity converts to an impurity content of about 2,000wtppm. The claims of the present application require 4N and 5N purities, which convert to 100wtppm or 10wtppm or less.

Thus, it is a considerable drop from 2,000wtppm to 100wtppm or 10wtppm. It should be acknowledged that as impurities are reduced, it becomes progressively more difficult to continue to further reduce impurities. Thus, reducing impurities from 2,000wtppm to 100wtppm or 10wtppm is no easy or obvious task, particularly when one of ordinary skill in the art follows the teachings of Chen relative to intentionally adding sodium hydroxide “once again” to neutralize the copper sulfate solution. Accordingly, Chen has no recognition of eliminating Na as an impurity and one of ordinary skill in the art is taught by Chen that Na content is acceptable.

As discussed on page 11, lines 5-13, of the present application, as filed, a purity of 3N (99.9wt%) is unacceptable when producing microstructure semiconductor devices. Of course, 99.8% disclosed by Chen is worse.

Further, claims 22, 23, 27, 28, 30 and 32 of the present application require Na content of 1wtppm or less, and claims 33-36 require Na content of 0.4wtppm or 0.3wtppm. No new matter was added. For example, see: page 9, lines 11-12; see Table 4 (4-2) on page 11 under the column header “Na”; and see Table 7 on page 14 next to the row header “Na”.

Since Chen requires “sodium hydroxide” to be added into the solution not only one time, but also, “once again”, there is no question that the copper sulfate of Chen will include more than 1wtppm of Na, and certainly more than 0.4 or 0.3wtppm of Na. See the Sworn Declaration of Takemoto.

Accordingly, Applicants respectfully submit that Chen fails to disclose the invention in as complete detail as contained in the claims as required for a rejection under §102(b). This is particularly true with respect to claims 22, 23, 27, 28, 30 and 32-36 of the present application which require specific limits of Na content not achievable by Chen. Thus, removal of the novelty/anticipation rejection under §102(b) of the claims of the present invention on the disclosure of Chen is respectfully requested.

With respect to the rejection based on §103(a), Applicants respectfully submit that it would not be possible for one of ordinary skill in the art to produce copper sulfate having a purity of 99.99% or higher from the teachings of Chen. In addition, Chen fails to disclose the critical nature of reducing certain types of impurities, such as Na, and fails to provide a copper sulfate having the “same utility” as the copper sulfate of the present invention. Further, semiconductor devices are continually being miniaturized and as the wiring and circuits become smaller, the presence of impurities such as Na, even at low levels, becomes a problem and causes such semiconductor devices to be defective. Thus, the present invention advances the state of the art with respect to electrolytic solutions for semiconductor manufacture well beyond that of Chen, which teaches that no problems are created via the intentional addition of Na impurities. Accordingly, Applicants respectfully submit that the claims are not obvious in view of Chen and that the §103(a) rejection of the claims should be removed.

For these reasons, Applicants respectfully request reconsideration and removal of the 35 USC §102(b) and §103(a) rejections of claims 20-34 as being anticipated by or obvious over Chen.

II. Conclusion

In view of the above amendments and remarks and in view of the factual statements in the Sworn Declaration of Takemoto, Applicants respectfully submit that the claim rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

Respectfully submitted,
Howson & Howson LLP
Attorneys for Applicants

By /William Bak/
William Bak
Reg. No. 37,277
501 Office Center Drive
Suite 210
Fort Washington, PA 19034
(215) 540-9216